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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

SECRETARY'S OFFICE, BIRMINGHAM, CONN., Jan. 10, 1890.

The Twentieth Annual Meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, Feb. 19th and 20th. The meeting will be called to order on Wednesday, at 10 A.M., by the President, Mr. R. B. Taber.

At the present moment it is impossible to give a list of the papers which will be read at the meeting, but it is hoped that the literary part of the programme will equal any of those held in past years.

Persons eligible for membership who desire to join the Association will please communicate with the Secretary, who will forward at once blank form of application. CHARLES H. NETTLETON, Sec'y.

[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY,
COLUMBUS, O., January 20, 1890.

To Members of the Ohio Gas Light Association:

Gentlemen—The Sixth Annual Meeting of this Association will be held at Toledo, O., on March 19 and 20, 1890.

This announcement is made thus early in order that all members may be reminded of the meeting in ample time to make their arrangements to be present. Every member is urged not only to attend this meeting, but also to interest himself in inducing others of his acquaintance who are eligible for membership, but who have not as yet joined the Association, to come to the meeting and become members.

It is not intended that as many papers as usual shall be presented at the forthcoming meeting, in order that more time than formerly may be had for the discussion of those that are read, and for such other matters and business as the members may desire to dwell upon.

Although the Secretary has for some time been engaged in the work of soliciting papers for this meeting, he has not yet secured as many as should be had, notwithstanding fewer are desired than heretofore, and he therefore earnestly calls upon all members who can possibly do so to notify him immediately of their willingness to furnish papers.

It has been decided that an interesting and valuable feature of our meeting would be a "Question Box," in which members can place questions, which will be withdrawn and read to the meeting and answered and discussed by the members. Every member is requested to send to the Secretary at once any question or questions which he would like to have thus brought before the meeting.

Future circulars will announce further details concerning the meeting.

Respectfully, IRVIN BUTTERWORTH, Sec'y.

OBITUARY—OLIVER E. CUSHING.

Again are we called on to record the death of a member of the fraternity whose persuasive personality and cheerful manner had always been potent in making for him a warm place in the hearts of his confreres—a place that once gained by him was never made vacant, so strong was his hold on the gentle force of retaining through innate merit and goodness and lovableness a friendship once sealed in the pact of companionship. The shining mark so unerringly aimed at by death in this instance was afforded by Oliver E. Cushing, who since 1860 had been agent and engineer of the Lowell (Mass.) Gas Light Company. Neither was the dread visitor ever a more silent conquerer. About a fortnight ago deceased experienced an attack of the prevailing influenza, but his seeming recovery had been to all appearances rapid—in fact on the day preceding his death he was able to leave his room—but even in the act of congratulating himself on his recovery an attack of heart failure carried him off. However, the end was painless, death claiming him at an early hour of the morning of the 17th inst. In accordance with our custom we herewith publish an account of his life, which can be accepted as substantially correct.

Oliver Edwards Cushing was born at Chelmsford, Mass., in March, 1829, and almost within view of his birthplace was the whole of his useful life spent. Having received an education in the local public schools, graduating with honor from Phelps Academy, in 1845, the tendency of which was to fit him for the profession of an engineer, he, in various positions, proved his worth and merit for business direction, and his success was such that the proprietors of the Lowell Gas Light Company—Chelmsford is but 3½ miles southwest of Lowell—invited him, in 1860, to the post of agent of their Company. To those not intimately familiar with the plan of conducting business corporations in some of the East-

ern States it might be well to explain that an agent is the virtual manager of his company, and in the case of Massachusetts gas companies the agent is usually the engineer also. So it was with the subject of this sketch, and his capacity as an engineer is shown in the fact that while many of his contemporaries were debating a decade and a half ago how to sell gas cheaply, Mr. Cushing was the leader in so selling it. In fact Lowell may justly claim the distinction of being the banner cheap gas city of America, where the rate for some time back has ruled at $1.10 per 1,000 cubic feet. We instance this merely to show what a progressive man Mr. Cushing was, and that his progressiveness found vent in action. To speak at length on the growth of the Lowell Company is not necessary here in illustration of Mr. Cushing's success in the management of its affairs. Suffice it to say that he was the zealous and capable director of its fortunes. In other local councils his voice was often heard, and many other local enterprises have been benefited by his direction. He was President of the Board of Trustees of the Lowell Cemetery, Vice-President of the Five Cent Savings Bank, and Clerk of the Vestry Board of St. Anne's Parish, of which church he had always been an ardent supporter. The only public office held by him was a chair in the Board of Aldermen (1885). Of his immediate family his widow and three daughters survive.

Turning now to his more extended relations with the fraternity of the country, the records show that he was one of the party of 16 who, at Boston, Mass., on February 2d, 1871, subscribed to the original articles of agreement forming the New England Association of Gas Engineers—this meeting being the sequel of the sad gathering at Worcester, Mass., of December 18, 1870, when the remains of the late Jas. B. Blake, ex-Mayor, and Engineer of the Worcester Gas Light Company, were consigned to earth. At the initial meeting of the Association Mr. Cushing was elected one of its Directors, and although he refused thereafter to occupy higher office in its gift, his voice and presence were ever at its command. He was elected to membership in the American Association at the second annual meeting—Brooklyn, N. Y., October 21, 1874—and his course therein was in accord with his history in the New England body. He became a member of the Society of Gas Lighting in 1876, and, if we mistake not, was a charter member of the Guild of Gas Managers, of which organization he was at one time President. Of all these bodies he was a member at the time of his death, and it need not here be said that his loss will be keenly felt by each.

The funeral services were celebrated at St. Anne's Church, on the 20th inst., the ceremonies being conducted by the Reverend Dr. Chambre, a close friend of deceased. The attendance was of a most noteworthy character, and could one have banished the knowledge of the sad reason why all were gathered in the sacred edifice, it would seem as if a joint conclave of the Guild of Gas Managers and the New England Association was in session at Lowell.

The moral that is to be drawn from this concise narrative of a busy, useful and even life, is that the gas industry of this country owes its present stability to the quiet though persistent efforts of such pioneers in its history as Oliver E. Cushing and others of his type. In conclusion, we have but to say—and our acquaintance with deceased covers a period of over a quarter of a century—that a kindlier gentleman nor a more faithful friend than Oliver E. Cushing ever found refuge from the cares of life in the repose of the grave.

OBITUARY—THEOBALD FORSTALL.

Before the first shock occasioned by the news of the sudden death of Mr. Cushing had abated, came a renewal of our sadness in the intimation that Mr. Theobald Forstall, of Chicago, Ills., had gone over to the majority. It is true that we were aware and shared with others in the apprehension so created that Mr. Forstall's tenure of life had been more than uncertain for some months back—but whoever of the living can accept with equanimity at once the bald fact that one's relative, colaborer or friend lies quiet in death? Mr. Forstall had for months been suffering from a malady that resisted all the skill of his physicians to ward off its insidious attacks, but many months, if not years of useful life seemed to be yet before him. The prevailing scourge that has so deeply set its mark on almost all the peoples of the globe aggravated his disease, to which he fell a victim on the evening of the 19th inst.

Deceased was born in New Orleans, La., in 1836, and traced his lineage back to the earliest French settlers of that section, many of his relatives having taken great part in the religious, civil and warlike events that make up the history of that section of our country when it was yet a French dependence. At an early age deceased was thrown completely on his own resources, and adversity soon developed those latent resources that would have made him successful in any branch of industry, and which did cause his name to be known, almost as a household word, wherever the art of gas making is practiced. In 1856 we find him located in Stillwater, Minn., where, at the age of 20, he was in control of an important business enterprise, relinquishing the same in 1860 to engage in the shipping business at his birthplace. The outbreak of the civil war all but bankrupted him, and next we find him in the Confederate army, from which he was soon released as invalid. In 1864 he became a bookkeeper in the counting-room of the New Orleans Gas Light Company, where his great knowledge—deceased was always a remarkably close student and a most retentive observer—soon brought him outside the narrow precincts of the counting-room. Shortly, then, he was named General Manager of the Company, and this was followed by his appointment (in addition to his other duties) as the Company's Engineer. In 1874 he was elected to membership in the American Association—2d annual meeting, Brooklyn, N. Y., 1874—and the potency of his personality was soon felt in its affairs. He was an earnest advocate before it of the abolition of Sunday labor in gas works, and his remarks on that subject, while commanding widespread attention to the subject, also directed the notice of his confreres towards himself. Although always something of an invalid, his bodily ills were in no wise reflected in his vigorous mentality. Logical, calm and just, he was not to be diverted by bombast nor influenced by flattery. Perhaps the ablest paper ever read before the American Association was that contributed by him to the third semi-annual meeting (Washington, D. C., May, 1875), on the subject of "The Proper Preparation of Lime for Use in the Purification of Coal Gas." At all events it established completely in this country Mr. Forstall's fame as an engineer. He served the Association as Vice-President in 1881–2, and was its President in 1883. In 1887 he became a member of the Society of Gas Lighting, and joined the Western Association at the Chicago meeting, 1888. There can be no doubt about the fact that to Mr. Forstall's ability and service much of the prestige attained by the American Association is due.

In 1882 three cities—St. Louis, Philadelphia and Chicago—bid for his services in connection with the engineering management of certain gas works. He elected to go to the last named, there to assume the Vice-Presidency and General Management of the Chicago Gas Light and Coke Company, and became President of the latter corporation after the Trust agreement was an accomplished fact—he resigned the Presidency on the occasion of the last annual meeting, Jan. 13th. The wonderful success achieved by him at Chicago is still too fresh in the minds of our readers to require recounting here. Taking hold of the affairs of the Company at a period when everything in connection with it was awry—a worn-out plant, sharp competition that savored of anything but fairness, and a disquieted host of customers—it required a steady hand and stout heart to master the difficulties that presented themselves. He solved the riddle and served his employers in a fashion that will cause his course to be long remembered by those who were dispassionate observers of the contest. But the victory was all too dearly bought. Anxiety and long vigils completed the wreck of a constitution at best never robust, and now the highest penalty has been exacted from him. It admits of no doubt that if ever a man wrecked himself on the deck of action that man was Theobald Forstall. He was in his leisure hours—unhappily, of late, all too few—a delightful companion, whose delicacy and wit were only outshone by his candor and polish. His wife and nine children survive him.

At the annual meeting of the Poughkeepsie (N. Y.) Gas Company Mr. W. H. Young was elected President, vice Mr. E. S. Atwater, resigned. Mr. Atwater has consented to act as legal adviser of the Company, retains his interest in the enterprise, and continues to hold his place as Director. Mr. Atwater accomplished much during his occupancy of the chair.

At the annual meeting of the Consolidated Company of this city the following Trustees were chosen: Gen. Chas. Roome, Thos. K. Lees, Oscar Zollikoffer, Thomas Rutter, Harrison E. Gawtry, Percy R. Pyne, Sam Sloan, Jas. W. Smith, Henry Day, John P. Higgins, H. Clausen, Jr., Wilson G. Hunt and Eugene Higgins.

The Market for Gas Securities.

Consolidated keeps making a net advance during each week, and today (noon, Friday) is at 97¼ bid, offered at 98. Apart from its intrinsic worth as an acceptable investment to ordinary investors, these shares have been largely absorbed within the last three weeks by companies (fire and life insurance, etc.) who seek safe and profitable places for a portion of their surplus funds. Other city shares are strong and higher, and the same applies to Brooklyn. Baltimore Consolidated holds its advance, being at 52½–53. Bay State (Boston) common is at 23 to 24, and this stock seems to us at the figure to be worth looking into. Advices from all points are favorable to the shareholder.

[A Paper read before the Society of Gas Lighting.]

Looking Backward.

By Mr. J. L. Hallett, Springfield, Mass.

This is a retrospective glance seemingly not unprofitable for us to consider at this time; for, in the light of the past and present condition of the gas lighting business, we may be able to discern and at least partly shape the pathway of the future.

Prior to 1871 there was neither a Society of Gas Lighting nor a kindred Association in this country devoted to the consideration and advancement of matters connected with gas engineering and manufacture. The gas manager stood alone, securely intrenched and fairly independent of outside influences respecting the growth of his business; and he had none of the care and worry of those in ordinary mercantile trade, with one or more competitors in the same block. He was particularly favored in that he controlled a monopoly, "With none to molest or make afraid."

The soliciting of business was unheard of; it must come to him. Every foot of service pipe, meter connections, each burner and every hour of labor taken up in completing the laying on of a gas supply were charged to the consumer, and at a handsome profit, too. Even a tax was levied for the use of that indispensable machine, of equal benefit to both producer and consumer—the meter—which furnishes the only effectual method of determining the quantity of gas sold, and accordingly the size of the gas bill.

Fifteen-candle power gas and a yield of 3.5 cubic feet per pound of coal carbonized was thought creditable, while a shrinkage of 20 per cent. in distribution was of slight concern, not worth digging for; for, at the prices charged, the shareholders were reasonably satisfied with the profits. True, it is thought that the fathers lived up to the light of their day and should not be severely criticised.

Gas Light Associations and weekly issues of papers devoted to the lighting industry have since multiplied, and both have found and imparted knowledge on the subject of gas and electric lighting which could in no other way be obtained. To these sources much credit is due for the brilliant progress made in our business during these later years.

Competition and would-be competitors—cheap oil with improved lamps and burners and electric lighting—have stimulated the gas manager to greater activity. With improved furnaces and settings the yield has nearly doubled, the waste has been reduced to a minimum, and the candle power is 25 per cent. greater, while the price charged is less than the product cost in the earlier days.

The custom of charging for setting meters and meter rental is almost wholly discarded. For the old-style closed globe and iron burner, with its flickering light, opal, etched and ground shades, with large opening and automatic governing burners have been substituted, producing a soft, steady and pleasant light. Formerly 3 candles per foot of gas was the maximum standard attained, but that is now in some States the minimum low limit. No company could exist with that power light against the present competing lights.

The high candle power burners of recent invention, developing 17 candle power per cubic foot of gas, have met the public demand for more light, and are boons to gas companies. What the outcome of this service will be we can only predict. Is it unreasonable to assert that in the near future the inventor will devise a burner—embodying the principles of the Lungren, Wenham, arc, and other high candle lamps, suited to parlor, library, and store fixtures, and in appearance not unlike the incandescent electric lamp, but devoid of shadows—that will develop 85 candle power in place of the common 5-foot burner of 18 to 20?

The efficiency of such a substitute would reduce the cost of lighting to so low a figure that few, if any, incandescent electric lamps would be found in public places, and new impetus would be given the gas lighting business. As 17 candles per foot is now developed in the larger burners, may a commensurate result not be attained in a divided light with a corresponding lessening of cost and heat?

The encircling of the town or city with electric wires, cutting out the hundreds of gas lamps, means a diminution of many million feet, which is a serious loss. Neither is it a pleasant thing to see the names of many of our best customers, of years' standing, dropped from the gas ledger by the inroad of a competing light company, with our only alternative to erect an electric plant or purchase from others a franchise of doubtful profit.

Because of the large increase in population and general business prosperity, the effect of the pushing electric companies has not yet been felt on the output. In fact, an increase is generally reported. These electric companies, in my opinion, would not in any sense be our competitors were the charges for electric light put on a commercial paying basis. This is evident from the large number of electric light companies that, having sunk their entire capital and sold out for a sum equivalent to their debts, have either gone into insolvency or are doing business at a loss. While this is the case, it is equally true that as the electric light becomes no longer a novelty, and it is demonstrated that for the same money more light can be obtained from gas, with more reliable service, former patrons return either wholly or in part to gas lighting. However, it is said that electric lighting companies have come to stay, and that they will demand and secure a share of the lighting business.

The problem, then, for us to consider is how to meet this competition and increase the yearly output. Without borrowing from the future for supposable or hoped-for devices for improving and further diminishing the cost of lighting with gas, how are the fires to be kept burning, and how is our revenue to remain intact, with the resources at our present command?

Fortunately there is a remedy. The gas manager has three strings to his bow—light, heat, and power. The last two have hitherto been secondary forces, and, comparatively, very little attention has been given to their development. Thanks to the meter and other manufacturers, the stoves, ranges, and other appliances for domestic and mechanical purposes, and gas engines for power, have reached a state of perfection that for efficiency and economy can without hesitation be recommended.

We might differ in opinion as to the best method for introducing such apparatus, but all will agree that the greater number of such devices that are put into practical use, either by gift, sale, or rental, the better it is for the receipts of the company.

Our policy in regard to stoves is, whenever possible, to sell them at cost, believing that an article that costs something will be more appreciated and have better care than if the property of others. A few ranges have been loaned at a nominal rental to those that could not afford to purchase.

To show what a limited knowledge the consumer has of these appliances. In a canvas made last summer we found some who did not know what a gas stove was. Many others were prejudiced, and thought the daily use of gas for cooking would be a ruinous expense. To overcome these prejudices, and to demonstrate the efficiency and economy of such a use of gas, 275 stoves were given away. These helped the sale of 248 more. The result was that the skeptical were more than pleased, and their old kerosene stoves were discarded forever. Statements were made by some that, to their surprise, the cost for gas was no greater than it had previously been for oil. The revenue from these gift stoves in one season paid for their cost and yielded a profit to the Company beside.

Without special advertising or any unusual effort to dispose of stoves, excepting in the case given, in four years 1,100 stoves have been placed, which, with those previously sold, make a total of about 1,900 now in use in our city.

The effect these have had on the output is shown in part by the amount of gas distributed from 8 A.M. to 3 P.M. in the months of June, July, August and September:

	June.	July.	August.	September.		
1886....	314,000	298,000	251,000	313,000	=	1,176,000 cu. ft.
1887....	317,000	314,000	431,000	485,000	=	1,547,000 "
1888....	488,000	527,000	540,000	614,000	=	2,169,000 "
1889....	568,000	633,000	604,000	720,000	=	2,525,000 "

This last item multiplied by three, to cover the gas used morning and evening, would give 7,575,000 cubic feet, the approximate amount to the credit of gas stoves in four months being 4,000 feet to each stove. This is 38 per cent. of the whole output for the summer months, and nearly one-tenth of the total output for the entire year.

While the increase in make in the months named in four years was 40 per cent., the increase in the stove consumption was 115 per cent.

In addition to cooking stoves and ranges, 48 heating stoves, of an improved pattern, and very effective for the work required of them, were sold for fall, winter and spring use—a total of 571 stoves in the year.

Looking backward and looking forward, here is a field that legitimately belongs to our craft for their occupation. The people only have to be taught the advantages that may be obtained by them in the use of gas for domestic and mechanical purposes and they will gladly adopt these appliances.

Systematic efforts would bring surprising results.

The City Council of Poughkeepsie, N. Y., have awarded the contract for public street lighting to the Electric Light Company, at its bid of $113 per arc per annum, while the Poughkeepsie Gas Company is to light the public buildings, at the rate of $1.75 per 1,000 cubic feet.

Utilization of Residuals from Coke Manufacture.

Mr. C. M. Percy is contributing a series of articles to the *Colliery Engineer* on the subject of improvements in coke manufacture in Europe, and a most interesting chapter in the series is his comment on the possibility of utilizing the residual products from such manufacture. In referring to the Pernolet system of doing this Mr. Percy says:

Before describing his apparatus in detail Mr. Pernolet proceeded to estimate the reduction in the price of producing coke which would result from the process. The supplementary products, due to the improved arrangements, were a larger yield of coke, and all the tar, the ammoniacal liquors, and the gas which would be obtained from the same coals if distilled in the retorts of a gas manufactory.

The increase in the yield of coke depended partly on the kind of coal, and partly on the way in which the charging was done before the introduction of the improvements. In the great coke works at St. Etienne, where ovens with hemispherically vaulted tops were used, the yield of coke had been advanced from 58.8 to 69.3 per cent., and at another establishment from 54.6 to 69.5 per cent.

In general it might be said that the increase in the yield from the rich and partially rich coals was from 10 to 15 per cent. Consequently, in distilling the same quantity of these coals, there would be a return of coke exceeding on an average one-sixth that which was obtained from the old ovens before their alteration. As to the tar, the amount collected depended on the nature of the coal, and on the care taken both in the distillation of the coal and in the condensation of its volatile products. This proportion had averaged 2.53, 3, 3.25 per cent., and had reached even as high as 5 per cent. where only very bituminous coals were employed. Taking, therefore, the average of these various averages, the amount of tar obtained from the bulk of coal distilled may be taken at 3 per cent.

The proportion of ammoniacal liquors depends not only on the conditions mentioned for the coke and tar, but also on the quantity of moisture contained in the coal.

At one works where unwashed coal was used, for every 100 parts of coal distilled there was not obtained much more than 6 parts of ammoniacal liquor; while at several other works, where the distillation was principally from washed coal, the quantity of liquor collected amounted to 10 or 12 per cent. But in other respects the useful substances contained did not appear to have any relation to the amount of water collected, and the aggregate of resulting ammoniacal substances showed but little variation for the different coals which had been tried.

Provided the condensation was properly attended to, the quantity might be stated at a weight of not less than 10 pounds, and sometimes of as much as 13 pounds of sulphate of ammonia per ton of coal distilled.

The gas obtained had only been computed at the ovens of one establishment, and it was found that by charging the ovens to a height of 2 ft. 4 in., and distilling 6 tons per oven in 72 hours, from 10,000 to 11,500 cubic feet of purified gas were generally obtained from a ton of coal, yielding from 69 to 70 per cent. of coke fit for delivery to the railway companies for locomotive use.

The density of that gas was to that of common air as 40 to 100, and its illuminating power was equal to that obtained from the same coal distilled in retorts, in the ordinary process of gas manufacture; so that the weight of purified gas was about 15 or 16 per cent. of the weight of the coal distilled.

Where coke is manufactured for metallurgical purposes, it is not usual to collect the gas given off, but it is conducted beneath the ovens, to be there consumed in maintaining the necessary temperature for distillation. Provided that the coal is rich or partially rich, this gas will be found sufficient for the purpose (precaution being taken to avoid the risk of explosion); but generally it is desirable to force the heat in order to obtain at once a firmer coke and a tar richer in benzine. This had been obtained without any increased expense, by burning, in addition in the fire-grate, either the small rubbish, which was not good enough to be sold as coke, and which at some places will form from 2½ to 3 per cent. of the coal distilled, or the residue from the washing, which is of usually small value, and may amount to 10 per cent. of the coal distilled.

At one establishment, where the heating of the ovens was entirely performed with gas coke from the retorts, from 22 to 23 per cent. of the weight of coal distilled was burnt; but as the coke contained probably not less than 12 or 15 per cent. of cinder, the consumption stated represented about 20 per cent. of pure coke, that is to say, of carbon. That statement would give an accurate idea of the maximum amount of heat required for ovens then actually in use, which were large and cylindrically vaulted, 23 ft. 4 in. long, by 6 ft. 8 in. wide, and were provided at both ends with openings the full size of the furnace, closed with cast-iron doors; an arrangement, however, not the most advantageous.

M. Pernolet said that by his improvements in the manufacture of coke, there could be extracted from 1,000 tons of coal 650 to 700 tons of good coke instead of from 500 to 600 tons; 25 to 40 tons of tar; compounds of ammonia, equivalent to at least 5 tons of sulphate of ammonia.

Now, then, as to value of these resulting products. Seven shillings to eight shillings per ton for coke (a very low price indeed; while we write, coke in England is selling at double these prices); twenty to thirty shillings per ton for the tar (that we venture to think will not now obtain;) and £14 to £15 per ton for the sulphate of ammonia (that also is an outside figure;) the total net value of the improvement under the Pernolet system, amounting to £100 per 1,000 tons of coal, or say two shillings per ton.

If it be assumed that at Newcastle, or say, County Durham, and at Wigan, Lancashire, in order to procure one ton of coke, worth say about 8 shillings (certainly a very much under estimate in 1889), it is not at all uncommon to use two tons of rich coal, and this certainly is not uncommon in Lancashire even yet, and that the nature of this coal is such as to permit of the extraction of all the supplementary products. M. Pernolet said it would be seen that the adoption of his ovens would effect a saving of more than four shillings per ton of coke manufactured, and consequently upon a basis of a selling price, eight shillings per ton would reduce the cost of production at least 50 per cent.

But great as even this was, the reduction might be carried still further. If all the gas, or even part of it, were made use of, as there was every facility for doing, particularly in the works which have both coke ovens and gas apparatus, and also in those small gas works where cannel coal is generally used, a substantial item of expense might be entirely got rid of by the alteration of some of the ordinary ovens; for the employment of the gas would effect so great an economy as to constitute an advantage equal or even superior to that which could be obtained from the supplementary products estimated at higher prices, because, since on the one hand the gas produced by the improved ovens was capable of supplying all the heat required for the distillation of coal, and on the other hand, the heat can be produced by 20 parts of carbon to 100 parts of coal distilled, it follows that the process of heating would not consume more than 500 pounds of the most ordinary coal to transform into coke a ton of coal yielding in the Pernolet ovens from 10,000 cubic feet to 11,500 cubic feet of gas, at an average expense of one shilling at the highest, or about one penny per thousand cubic feet, or at less than the thirty-sixth part of the lowest price of gas employed in Newcastle, North of England, for the town supply.

[I have very often been struck with the pertinacious manner in which a certain class of inventors will exaggerate the possible benefits of their invention. The gas made and supplied to the principal towns of England not only does not cost three shillings a thousand cubic feet, but can be made and is put into gasholders at less than one shilling a thousand, and neither the Pernolet nor any other system can give us gas at a penny a thousand. We are having just now in England, a craze about water gas, and upon this some excellent criticisms were made at the recent Paris meeting of the Iron and Steel Institute.]

The reduction, says M. Pernolet, in the price of coke effected by the use of his ovens, would generally be at least from four shillings per ton to four shillings and sixpence per ton, and it might amount to eight shillings or nine shillings per ton.

[It really amounts to this, that as compared with the ordinary process of coke manufacture, we should have all the amount of coke we used to make, produced free of cost.]

But it is important to make a more profitable use of the gas than that which it had been applied at the establishments referred to by M. Pernolet; for it was frequently burnt when the most ordinary description of fuel would afford all the heat required, and when the large supply of gas might be increased in value, by reserving it for special purposes, not limited to the lighting of towns, but extended to heating steam boilers or stoves, or the air of blast furnaces, or to evaporating and distilling liquids, puddling cast iron, reducing mineral oxides, and to many other uses of which some had got to be, and no doubt would be, discussed.

[It strikes one upon reading this that hot air for blast furnaces or steam boilers in connection therewith can hardly be included. Blast furnaces as now worked produce sufficient and more than sufficient waste gas to heat all the blast and generate all the steam.]

But sufficiently varied as the best possible purposes which we have named would seem to be, M. Pernolet was not exhausted, and he remarks that it has been proved that one of the elements of illuminating

gas may be transformed into alcohol, and that hitherto that manufacture had only been stopped by the expense of evaporating the dilute sulphuric acid which is present in large quantities. The gas of the Pernolet ovens being able to furnish at once both a supply of alcohol at a low price and a fuel eminently fitted to evaporate it, might perhaps help to introduce the manufacture into the field of commerce.

As regards the use of gas in blast furnaces, for the manufacture of cast iron, an application of it had recently been made in France, by which it was said a purer iron had been obtained, with a saving of 40 per cent. of the fuel usually necessary; and it was also stated that after several weeks' experience twenty Pernolet ovens yielding on an average 20 tons of coke per day, would keep one blast furnace supplied both with coke and gas.

So far, in his remarks, Pernolet had been referring to the employment of the richer, more bituminous kinds of coal, and these were in fact the best adapted for obtaining the products of distillation. But, though the saving would not be so considerable, the Pernolet oven might be profitably used for the poorer coals, and even for the anthracites, provided that some of the richer kinds be used with them. [It is now an unusual occurrence to mix bituminous and anthracite coals for coking. When I visited South Wales last year, I found that the Coppee oven made coke with much success from a mixture. The bituminous coal was too gaseous, and the anthracite coal not gaseous enough, but a proper mixture was found just the thing.]

In such cases the economy would consist chiefly in the smaller quantity of the superior coal required, but of course the products would be proportionally less abundant, in consequence of the small amount of tar, hydrole of ammonia, or gas furnished by the poorer part of the mixture. There would, however, result an important reduction in the price of coke, not only on account of the saving effected in the distillation of the rich coal, but because the poorer kinds, when thus mixed with the richer, instead of being charred alone, would yield three times as much coke as when used singly; in fact, by means of this mixture, it was easy to transform into good coke such coals as were usually considered incapable of being charred, or at least of yielding coke in pieces of an available size.

The collieries of Earl Granville, at Hanley, North Staffordshire, are mentioned as an example where two sorts of coal are used; one flaring, but poor, which had hitherto only been charred in the open air, and in large pieces; and the other partially rich, which was charred in the ordinary ovens—all the poor and comparatively small coal, in pieces less than six inches thick, being rejected. Yet, by mixing it with the partially rich kind found in that neighborhood, and by charring the whole in the Pernolet ovens, the poorer coal might be used with facility, and at least 65 per cent. of good coke would be obtained, instead of the 45 or 50 per cent. produced by the rich coal, when charred by itself in the coke ovens in ordinary use.

In certain cases, also, tar, or dry pitch, might be used with coals which had little or no bitumen, and which were at the same time too brittle to be put into blast furnaces in their crude state. By the admixture of from 8 to 10 per cent. of the above substances, these coals would be supplied with all the bitumen in which they were naturally deficient, and would then become profitable for use in blast furnaces; for if only the small, cheap coal were consumed, the cost of the mixture would not exceed that of ordinary coking coal. Still, the agglomerating matters, being much more expensive than the small coal with which they are combined, it is always important to economize them; and the best way of economizing them is to exclude the air, and thus prevent them from burning, and to collect the products of distillation, and to contribute to their formation during the process.

These recommendations, said M. Pernolet, constitute the leading characteristics of the new system.

The Limiting Pressure upon Foundations.

A writer in the *Mechanical World* notes that very little data is available as to the limiting pressure to which foundations may be subjected. Since the safe load will vary considerably with the nature of the soil, the only satisfactory method of determining this important factor is by direct experiment. In the erection of the weighty and lofty structures on the Champ de Mars, in Paris, in connection with the exhibition, experiments were conducted with this object in view, for the purpose of determining the size of foundations. The method adopted was to level a large surface of ground and place four rectangular blocks of cast iron, 1 foot 8 inches square, so disposed as to form corners of a square, the distance apart being 11 feet 8 inches from center to center. These blocks were bridged by girders of T-iron, and these were then loaded with the same until a total weight of 143,923 pounds was reached, when a settlement occurred. The pressure on the ground was 7,311 tons per square foot. During the night the settlement increased about ¼ of an inch. The load was increased next day to 209,776 pounds, when some of the corner blocks had sunk out of sight, leaving the girders on the surface of the soil. It was found by these experiments that the soil was capable of resisting a load equivalent to 5.43 tons per square foot. When the load reached 7.31 tons, settlement took place, and the ground was incapable of supporting a load of 8.14 tons per square foot.

Origin of the Rock Pressure of Natural Gas in the Trenton Limestone of Ohio and Indiana.

The appended facts are taken from a paper on this subject delivered by Prof. Edward Orton (State Geologist of Ohio) at the New York meeting of the American Geological Society.

Natural gas derived from the Trenton limestone has supplied during the last year, and is now supplying all the fuel and a considerable part of the artificial light that is used by at least 400,000 people in Northwestern Ohio and in Central Indiana. Within the same limits it is the basis of a varied line of manufactories, the annual product of which will make an aggregate of many millions of dollars. More than 40 glass furnaces, not one of them three years old, are now in very successful operation within the territory named, while iron and steel mills, potteries and brickworks, and a long list of factories in which cheap power is a desideratum, have been built up on all sides with wonderful rapidity.

The largest gas production of Trenton limestone that has yet been reached is to be credited to the present year. A well drilled at Stuartsville, six miles north of Findlay, early last summer, produced through the casing, a pipe 5⅝ inches in diameter, 28,000,000 cubic feet of gas every 24 hours. There are but few wells in any fields that exceed these figures. Most of the wells that have been so reported have been estimated, not measured. An equally astonishing advance had been made in the oil production of this rock, within four counties of Northwestern Ohio. Single wells during the last year have begun their production at a rate of 10,000 barrels a day, and more than 200,000 barrels of total production are already to be credited to single wells of the new field, while a considerable number have passed the 100,000 barrel mark.

The rock pressure of the gas is a vital factor in all this production. To its energy is due the propulsion of the volatile fuel from the wells where it is released through 20, 30, 50 miles of buried pipes to the cities which it supplies with the unspeakable advantages of gaseous fuel. This is the same cause that lifts the oil from the rock in all flowing wells.

By rock pressure is meant the pressure which a gauge shows in a well that is locked in after the drill has reached the gas reservoir. The iron tubing of the well becomes by this means a part of the reservoir, and the same conditions as to pressure are supposed to pertain to it that are found in the porous rock below. The rock pressure of gas varies greatly in different fields, and to a less, but still an important extent, in different portions of the same field. The highest rock pressure recorded in the Trenton limestone is about 650 pounds to the square inch, while there are considerable sections of the gas territory that never reach 300 pounds pressure per square inch. The original pressure in the Findlay field was 450 pounds, varying somewhat in wells of different depths.

In the Wood county field from which the largest amount of gas is now being conveyed to Ohio cities the original pressure ranged from 420 to 480 pounds, the general pressure being counted 460 pounds to the square inch. There were occasional records made of higher pressures still in single wells, but of such cases the number is very small, and the existence of these incredulous pressures was short lived.

In the Indiana field a still greater reduction of rock pressure is noted. The range of the principal Indiana wells is between 250 and 325 pounds to the square inch. The Indiana gas wells, as compared with the Ohio gas wells, are marked by a reduction in total depth as well as in rock pressure, the figures for depth in the productive territory seldom or never passing 1,000 feet.

Sagacious operators are becoming satisfied by their own experience that the root of rock pressure is to be found in the water column that stands connected with the porous rock in which the gas and oil are contained.

When the drill descends into the gas rock proper, dry gas escapes; when into the contiguous and lower-lying terrace, oil accompanied by the gas appears; but at a little lower level salt water is struck, and this rises promptly in the well, sometimes to the point of overflow. Far out from the narrow ridges, or restricted terraces, where gas and oil are found, the salt water reigns undisturbed, and whenever drilled to it, rises in the wells as in those already described.

The rise of the salt water is unmistakably artesian. It depends on hydrostatic pressure, as does the flow of all artesian wells, and its head must be sought, as in other like flows, in the higher portions of the structure that are contiguous. The nearest outcrops of this porous Trenton are found in the shores of Lake Superior, at an altitude of about 100 feet above tide.

It is certainly significant that an abundant flow of salt water is struck in boring in Northern Ohio or in Indiana. No matter at what depth, it rises generally to the level of Lake Superior, or, in other words, about 600 feet above tide. If the mouth of the well is below this level, as in the case in the Wabash Valley, the salt water overflows. The height to which the salt water rises in any portion of the field is one of the elements to be used in measuring the force which can be exerted on the gas and oil that are caught in the traps of the terraces and arches of the porous Trenton limestone.

The rock pressure of the gas differs at various points, because of the difference in depth of the rock below sea level. The rock pressure of Trenton limestone gas is due to a salt water column measured from about 600 feet above tide to the level of the structure which yields the gas.

There is no danger that the great gas reservoirs of to-day will "cave in" or "blow up" after the gas is withdrawn from them. The gas will not leave the porous rock until the salt water obliges it to by driving it out and taking its place. The doctrine lays the axe at the root of all the optimistic theories which blossom out in every district where natural gas is discovered, and especially among the real estate operators of each new field, to the effect that nature will not fail to perpetually maintain or perpetually renew the supplies which we find so delightfully adapted to our comfort and service. So far as we are concerned, it is certain that nature has done about all that she is going to do in this line. In her great laboratory a thousand years are as a single day.

Judging from the present indications, the Trenton limestone gas in Ohio is not likely to be long-lived. It seems entirely probable that the term of its future duration can be expressed within the limits of a number of one digit. In considerable sections of the field the salt water is very aggressive. It requires a steadily increasing pressure on the wells to hold it back.

Mr. Trewby on the Manufacture of Water Gas.

The London *Journal* has interviewed Mr. G. C. Trewby, of London, on his visit to America, with the following result:

The great attention which is now being paid by gas engineers and managers throughout the United Kingdom to the question of the manufacture of water gas, induced us to invite Mr. G. C. Trewby, the Chief Engineer of the Gas Light and Coke Company, to send for publication in these columns a communication giving an account of his recent trip to America, and the results of his investigations, on behalf of his Company, into the various water gas processes which are in operation in that country. Owing to the pressure of business engagements Mr. Trewby could not comply with our request, but courteously suggested that a representative of the *Journal* should wait upon him. The suggestion was carried out a short time since when Mr. Trewby gave a *resume* of the information which he gathered in America. This we now present to our readers practically in Mr. Trewby's own words.

Acting under the instructions of my Company, I recently visited the United States and the borders of Canada, and made myself acquainted with some of the principal carbureted water gas processes in use there. I found in most of the cities that carbureted water gas was more or less manufactured. In New York about two thirds of the supply is water gas, and at Toronto, one-half. At Chicago, on one day in September, when I was there, 7 million out of the 8½ million cubic feet supplied were water gas. At Washington the proportion of water gas varies according to the daily consumption—ranging in the winter time from 35 to 50 per cent. I am not able to give the proportion in all the towns, because I had not time to visit all the companies or works to collect statistics; but it will perhaps be sufficient for me to state that where petroleum spirit or crude oil is bought cheaply the manufacture of water gas is on the increase.

The reasons which have led the different companies to supplement their coal gas supply with water gas have been, in the first place, the cheapness of petroleum; and, secondly, the desire on the part of the public to have a higher illuminating power. In some of the towns companies have been started for the exclusive purpose of manufacturing nothing but carbureted water gas under special patents. In New York there are three distinct Companies who make nothing but this gas, besides the Consolidated Company, who make something like one-half. The illuminating power of the water gas supplied in New York is about 30 candles; and the peculiarity about this high illuminating power is that the gas burns with a clear white flame without any appearance of smoking. It has been found to satisfy the public requirement of a high candle power, and is a successful rival of the electric light wherever introduced. In the case of some few works that I visited where coal gas of about 16-candle power was supplied, the consumption had fallen off year by year during the last few years, and the electric light had made considerable advance. As far as I was able to judge there does not seem to be much consumption of the gas for cooking and heating purposes; but this may be accounted for by the price ranging from 5s. to 8s. per 1,000 cubic feet.

A good deal has been said about the deleterious nature of water gas by reason of the large percentage of carbonic oxide it contains. Plain water gas contains about 40 per cent. of carbonic oxide. But in carbureted water gas the proportion is reduced to about 32 per cent., and by specific processes even below that. The quantity in ordinary coal gas is about 6 per cent. Of course, there is no prejudicial effect produced by burning a gas containing a large percentage of carbonic oxide. The danger is that when an escape takes place fatal effects are likely to be produced much sooner by breathing an atmosphere of this kind than with an atmosphere of coal gas. Notwithstanding this, I was informed that during the seven years water gas has been used in Chicago not a single death could be traced to this cause.* The old Boston Coal Gas Company, who opposed the introduction of water gas some years ago, induced the Legislature of Massachusetts to pass a law limiting to 10 per cent. the maximum amount of carbonic oxide to be allowed in that city; and although this would allow of an admixture of water gas equal to 16 per cent. of the whole bulk, yet it has been found impossible to make anything like this quantity and still get within the limit, because the water gas and coal gas could not be thoroughly mixed together, and the official tester might be able to find some particular point where more than the allowed 10 per cent. of carbonic oxide existed. The present Boston Gas Company hope to have the law abrogated, especially as Massachusetts is the only State in the Union that has passed it; and, as far as I am aware, nothing of the sort exists in Canada. This being the state of the case, I think there is no fear of any legislative action that would interfere with the judicious use of carbureted water gas in this country.

Passing on to a description of the manufacture of water gas, I may shortly state that it is a very old invention; some patents in connection with it being taken out by Kirkham in 1852. The gas is produced in a vessel after the style of an iron cupola—either rectangular or circular—which is filled with anthracite coal or coke. The heat is brought up to the point of incandescence by blowing air into the cupola; and the products of combustion are allowed to pass off into the air. The next operation is the making of the water gas, which is effected by shutting off the air, and blowing superheated steam through the fuel. The steam being composed of hydrogen and oxygen, these two gases are separated. The former passes off in a free condition, and the latter combines with the carbon of the fuel, and forms carbonic oxide. These two gases, together with some carbonic acid and nitrogen, and a small percentage of sulphureted hydrogen, form what is known as crude water gas. The effect of the steaming is, of course, to bring down the temperature of the fuel. Therefore, at the end of ten minutes, this has to be discontinued, and the mass of fuel blown up again with air; and about every two hours or oftener, fresh fuel has to be added.

There are three distinct methods of carbureting the water gas. One is known as the Tessie du Motay process. In this the gas is taken to a small gasholder which acts as a governor; thence it is led into a carbureting vessel supplied with naphtha; and from there it passes up to the fixing retorts, which are ordinary clay gas retorts. The water gas and naphtha go in at one end of a 20-feet retort, and out at the other end as a fixed gas; the contact with the red-hot sides making the fixing permanent. The gas then passes into the hydraulic main, and from thence through the washers, etc., in the ordinary way to the gasholders, I was told that, in the cold weather, the gas does not suffer any greater loss in illuminating power than cannel gas.

The second method of carbureting consists in the use of what is called a superheater, which is a circular or rectangular vessel, surrounded by sheet iron and lined with fire brick, and filled with pigeon-holed work. The operation consists in passing the hot producer gas through this vessel; admitting, if necessary, a secondary supply of atmospheric air to effect the complete combustion of producer gas. By this means, the superheater is made red hot; and when the water gas is generated, it is passed through this vessel, and at the same time naphtha or oil is spread on the top of the producer or bottom or top of the superheater—depending upon the course the gas is made to take. This makes an illuminat

* Mr. Trewby must be incorrectly reported in respect to this.—Ed. A. G. L. J.

ing gas of a permanent character, but not of such a constant or rich quality as by the first-named method, although the cost is apparently less. One advantage it possesses is that crude petroleum or "gas oil" can be used, which is inadmissible in the Tessie du Motay method.

The third process consists in carburetting the water gas in the cupola, without the use of a subsequent superheater. The operation consists in blowing up the cupola in the ordinary way; then, while the steaming is proceding to make water gas, naphtha is introduced in several places round the circumference, and about two-thirds of the height of the incandescent fuel. Therefore the naphtha vapor would have to pass through one-third of the heated carbon in contact with water gas; and it is claimed that the same action takes place as with the use of a separate superheating vessel. Great care is exercised to keep the fuel at one regular height.

There is another process which differs very much from the foregoing. It is called the Jerzmanowski; and the object of the process is the reduction of the amount of carbonic oxide made. The operation is as follows: A fire-clay retort is set in an oven. Is is filled with limestone, which is heated to redness. Steam and naphtha vapors are introduced into the mouthpiece of the retort, and passed up through the heated limestone, which decompose some portion of the carbonic oxide formed, substituting for it carbonic acid. Another modification of the same plan is by the use of a rectangular producer divided into two parts. The first half is filled with anthracite coal or coke, and the second with limestone, The heat is blown up in the usual way; and the producer gas passes down through the limestone. When gas is being made, naphtha is passed on to the top of the limestone at the rate of 1¼ to 2 gallons per minute. The effect of this method of working is to reduce the carbonic oxide from what it would be in the ordinary way—namely, 32 per cent.—to not more than about 20 per cent. This gas, which has an illuminating power of about 5 candles, is conveyed to a governing gasholder, and brought back to the coal gas system of retorts to be carbureted in the same way as in the Tessie du Motay process first described. The process was originally introduced to meet the objection that has been raised to a large percentage of carbonic oxide, the reduction of which can only be effected by changing it into carbonic acid, which has no heating power, and exists as a diluent of the gas. It is claimed that the illuminating power is not appreciably lessened by leaving it in; a small extra amount of naphtha being sufficient to compensate for the deterioration in the illuminating power.

There is a process called the Meeze, which has been experimentally tried in New York, with very favorable results, for a period of fourteen months, and is now about to be tried by The Gas Light and Coke Company at one of their works. The apparatus consists of a circular retort, 18 inches in diameter, and 20 feet long, through the centre of which a cast iron pipe, about 6 inches in diameter, is led from one end to the other. The oil to be used, and superheated steam, are passed through this pipe to the extreme end of the retort, and find their way back between the pipe and the sides of the retort in contact with conical deflectors; and in this way a certain quantity of steam is taken up in combination with the oil, and made into a very rich gas. The water gas, manufactured in the ordinary way and already stored in a holder, is brought into contact with this gas, either in the retort or in the hydraulic main; the result being that a gas of 27-candle power is said to be produced. This process was brought out for the purpose of dealing with the heavy oils and petroleums, and is thought to be thoroughly suited for the Russian petroleum, which is very heavy, and contains but little naphtha. If anything is to be done in introducing water gas into this country to any large extent, it will probably be by means of the importation of Russian petroleum, which, as far as I can see, is likely to be delivered here at a cheaper rate than American oil, unless it be the Lima oil, which is found in the State of Ohio. This oil, however, contains a large quantity of sulphur. It must be understood that, in the manufacture of water gas, no alteration is required in the existing plant of a gas work. The only addition would be a cupola, and the necessary blowing apparatus for getting the fuel up to a state of incandescence.

I cannot close my account of the various processes I inspected without mentioning the cordial way in which I was received by the different gentlemen connected with the gas industry in America and Canada with whom I came in contact, and to whom I am greatly indebted for the amount of useful information I have collected.

THE new Lowe type of water gas apparatus recently installed on the Pottsville (Pa.) plant by the United Gas Improvement Company was started up about a fortnight ago. No hitch of any kind occurred at the initiation.

Paints and Painting for Iron Work.

Some time ago, in an article on "Paints," the London *Journal* remarked that whether the winds of the season breathe soft or biting, the approach of spring never fails to bring one sign of its presence beside lengthening days, and that is, the painter. Continuing, the commenter says:

It almost appears that the forcing process whereby the period of youth and immaturity has been abbreviated in many modern instances has extended to the years, and that spring is hurried over, not to make more room for summer, but to allow the artificial mist and gloom which exaggerate our winters to work out their full developments. Whether winds breathe soft or biting, however, what becomes of painters in the winter is a problem upon which other varieties of the British workman are wont to exercise a rough-and-ready wit; but it is certain that, whereas town residents learn through correspondence in the newspapers that those traditional harbingers of spring, the swallows and the cuckoo, have been seen and heard in country places, they might retaliate upon country cousins by naming as urban spring visitants the cheerful painter and his associate the whitewasher. Not only do town residences confess the presence of these busy visitors, making life so intensely wretched for anybody else who cannot get out of their way; but also in the grimiest factories painters are manufactured out of "handy men," and set to touch up iron and wood work stained and worn by the long winter's wear. The moden extension of the use of wrought iron and steel in place of the less perishable cast iron, has rendered the regular use of the paint brush imperative in places where it was formerly seldom seen. In gas works particularly, there is now much more wrought iron and steel than could have been found a generation earlier, and the consumption of paint has accordingly largely increased. The manufacture of paints for iron work is a very much more important industry than it used to be; but it is to be feared that in many cases increased excellence of the product has not accompanied the swelling of the trade. Of course it may be said, and with a great deal of truth, that the advance of knowledge in the matter of paint making has in some respects led to many improvements in the character of paints in general, and especially in regard to the preparation of paints for special purposes. Paints can now be bought that will cover and stand and preserve their colors when applied to purposes for which a few years ago painting was regarded as an unavailable means of protection. All the same, there is much truth in the reproach that when the application of chemistry to manufactures facilitated adulteration, it was in the paint, varnish, and oil trades that scientific sophistication found its favorite home.

Consideration of paints and painting is, as we have already said, seasonable just now; but it is also suggested by a paper of Professor V. B. Lewes, F. C. S., etc., read before the Institution of Naval Architects. The corrosion of iron ships is a subject which, regarded in its narrowest aspect, would not appear to specially interest gas engineers. Looking at ships as structures built of iron and steel, however, and only differing from other structures in the same materials by the severity of the corroding influences and strains to which they are exposed, it becomes clear that all who are interested in the preservation of these materials from the destroying influence to which they are naturally liable, must be able to draw valuable instruction from the experience of those who have to deal with these influences when manifested in their extreme rigor. Iron is perishable everywhere and under all ordinary conditions of use; but what will preserve the ironwork of a ship would, as one may reasonably conclude, preserve ironwork anywhere. It is this thought that impels us to devote some attention in these columns to Mr. Lewes's interesting paper.

The author does not set out with any claim to having made or heard of any new or startling discoveries in connection with his subject, but merely desires to keep the matter before the world of technical workers in iron and steel, in order that the ever-present importance of this particular quality of iron structures—perishability—should not be lost sight of. Professor Lewes has already done good service by pointing out in a paper read two years ago that in all processes of rusting, carbonic acid gas and moisture play an important part, the iron uniting with the carbonic acid and oxygen of the water to form ferrous carbonate, then taking up oxygen dissolved in the water, or present in the atmosphere, as the case may be, and decomposing into ferric oxide (rust) and carbonic acid, which being liberated in actual contact with the moist surface of the iron, carries on the process of "rusting." This view of the phenomena is confirmed by a paper read by Professor Crum-Brown before the Iron and Steel Institute in Edinburgh, and is generally accepted as the true explanation of the corrosion taking place on iron or steel surfaces

exposed to moist air or fresh water. The action of salt water on iron has been supposed by some chemists to involve a more complicated reaction; but Professor Lewes is persuaded that this is mythical, and that there is no essential difference between the rusting of iron in salt water and in fresh. Salt water, however, may, and probably does, set up a galvanic action between iron and any foreign substances in contact with it; but with this part of the question we are not particularly concerned. Any place where wet coal or carbon dust is brought in contact with iron, which is specially the case in gas works, is held by Professor Lewes to show speedy corrosion of the metal.

Dismissing metallic coatings of ironwork as unsatisfactory, Professor Lewes enumerates five divisions of non-metallic preservative coatings in common use. These consist of oil paints; pitch, asphalt, tar, or waxes; varnishes consisting of resins and gums dissolved in volatile solvents; varnishes containing substances to give them body; and coatings of cement. Before going into these in detail, he gave some necessary consideration to the condition of the surfaces to which they have to be applied. When an iron structure is scraped down to the bare metal, there is presented a huge surface which varies in temperature much more rapidly than the surrounding air. As it cools, so the iron chills the layer of air in immediate contact with it, and shows, by what is called "sweating," the deposition of surplus water on its surface, over which the protective coating has to be applied. If now a rapidly drying varnish is put on, the evaporation of the volatile solvent causes again a further loss of temperature, which brings another deposition of condensed moisture, this time on the surface of the protective, so that the coating is sandwiched between two layers of moisture, both of them probably acting deleteriously upon the resin or gum of the varnish, whilst the moisture on the iron also prevents adherence of the varnish to the metal. If instead of a quick-drying varnish a paint had been used, the second deposition would not have taken place; but the sweating of the iron would have prevented cohesion, and when dry, any rubbing of the coating would bring it off in strips. The condition of the skin of an iron structure, while the coating intended to protect it is being applied, is one of the prime factors in the observed discrepancies in the behavior of such compositions. Too much stress cannot be laid upon the condition of the surface of the iron at the time of coating; and it is perfectly essential either to have a dry surface or else a composition which is not affected by water. The author remarks that when an old iron structure is broken up, on the backs of the plates may often be seen the numbers painted on them in white lead and linseed oil when the work was put together, and under the paint the iron in a perfect state of preservation, the secret being that the paint was put on while the plates were hot and dry.

Compounds prepared with boiled linseed oil are, however, open to objection, on account of the presence of lead. The drying of boiled linseed oil is due to the fact of its containing a certain quantity of an organic compound of lead; and the drying property is moreover imparted by boiling it with litharge (oxide of lead), so that lead compounds are present even when the oil is not mixed with red or white lead pigment. When boiled oil dries, it does so by absorbing oxygen from the air, and becomes converted into a kind of resin, the acid properties of which also have a bad effect upon iron. Protectives of the class of tar and its derivatives, such as pitch and black varnish, and also asphalt and mineral waxes, are regarded by Professor Lewes as among the best. Certain precautions, however, must be taken in the case of tar and tar products, both of which are liable to contain small quantities of acid and of ammonia salts. If care is taken to eliminate these, and if it could be contrived to always apply this class of protectives hot to warm iron, the question of protection would be practically solved; bituminous and asphaltic substances forming an enamel on the surface of iron which is free from the objections to be raised against all other protectives—that is, of being microscopically porous and therefore pervious to water. Spirit or naphtha varnishes are condemned by Professor Lewes as open to several objections. Varnishes to which a body has been given by some pigment, generally a metallic oxide, are preferable to the last class, "if the solvent used is not too rapid in its evaporation, and if care has been taken to select substances which do not themselves act injuriously upon iron, or upon the gums or resins which are to bind them together, and are also free from any impurities which could do so."

At the present time, as the author truly remarks, the favorite substance for this purpose is the red oxide of iron; but care should be taken to exclude from it free sulphuric acid and soluble sulphates, which are common impurities and extremely injurious. The finest colored oxides are, as a rule, the worst offenders in this respect, as they are made by heating green vitriol (sulphate of iron), and in most cases the whole of the sulphuric acid is not driven off, the heat required being injurious to the color. The acid is often neutralized by washing the oxide with dilute soda solution; but very little trouble, as a rule, is taken to wash it free from the resulting sulphate of soda, which is left in the oxide. The best form of oxide of iron to use for paint making is obtained by calcining a good specimen of hæmatite iron ore at a high temperature. When prepared in this way it contains no sulphates, but a proportion of clay which is harmless if it does not exceed 12 to 18 per cent. Paint makers can easily test their red oxide for soluble sulphates by warming a little of it with pure water, filtering, and adding to the clear solution a few drops of pure hydrochloric acid and a little chloride of barium solution. If a white sediment forms in the solution the sample should be at once rejected.

In the application of a preservative coating to iron, Prof. Lewes directs, first, thorough scraping and scrubbing from all non-adherent old paint and rust. New iron should be pickled with dilute acid to get rid of every trace of mill scale; the acid to be neutralized afterwards by a slightly alkaline wash, and this again to be washed off by clean water. Under these conditions, and given a composition of good adhering properties, but little apprehension need be felt with regard to the ravages of corrosion, the chief remaining risks being from abrasion or other mechanical injury to the composition, coupled with improper constituents in itself. In conclusion, we have only to recognize the great care and knowledge with which Prof. Lewes has prepared his paper, which has been reprinted, and may be profitably consulted in detail by all who are in any way interested in the subjects of ironwork and ironwork paints.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Jan. 10, 1890.

Gardner's Gas Globes.—The Rights of the Sweep.—Recent Strikes.—Dangers of Civilized Life.—Mr. G. C. Trewby on Water Gas.

Mr. D. R. Gardner, of Glasgow, has lately directed attention to a fact which has been pointed out in other ways on two or three occasions previously, but has not hitherto attracted the attention of gas consumers to any important extent. It is nevertheless a matter of great importance to all users of gas who wish to obtain the best possible value for their money. I allude to a principle first illustrated by Michael Faraday, about 50 years ago, by surrounding an ordinary argand gas burner with a cylindrical glass chimney about one inch or so larger in diameter. The air for the supply of the flame was thus caused to enter at the top of the outer chimney, and passing down the annular space between the two glass cylinders, became heated to a considerable degree before reaching the gas burner. The result was a great improvement in the "duty" obtained per cubic foot of gas used, and it was due to two causes. The first was a diminution in the quantity of air passing through the gas burner, and the second the heating of the air previously to reaching the flame. These two causes are both concerned in all endeavors to improve gas burners. In the modern regenerative burner it is usual to claim that a great advantage results from the heating of the air supply by means of some of the waste heat from the products of combustion. But a par of the benefit is undoubtedly due to the fact that the air supply, in following the tortuous course designed for it, is greatly diminished as compared with the supply of air that reaches an ordinary open flame. Just as a large excess of air admitted to a boiler furnace reduces the heating effect obtained from the fuel by taking away a part of the heat, so the large volume of air, rushing up the chimney of an argand burner, or through the openings of an ordinary globe, diminishes the flame temperature, and thereby causes a certain loss of light. Some few years since, Mr. Lewis T. Wright showed that by the simple expedient of a disc, the same diameter as the chimney, supported on the top by a cross bar and adjusting screw, the air supply could be adjusted to suit the quality of the gas consumed. The cap, in effect, is analogous to the damper of an ordinary furnace, and just as careful adjustment of the damper will economize the fuel, so attention to the air supply of the burner will economize the light. The same thing may be illustrated by introducing halfpence, one on the other, under the central opening in a Standard argand burner, and it is quite possible to increase the quality of the gas to the extent of a candle or two by this means.

Mr. Gardner applies this principle to ordinary globes in a very simple manner. He cuts a disc of asbestos sheet rather larger than the top of the globe, and fits on the under side three asbestos studs, each moving on an eccentric axis, for the purpose of accurately fixing the disc in contact with the top of the globe. At first it was found that the heat of the discs would cause the globes to break, but this objection was entirely overcome by the use of strips of mica between the disc and the globe. They ac efficiently as a non-conductor. An opening about 1¼ inches in

diameter is punched out of the center of the cover, and is covered by means of a circular piece of similar size, hinged on a pivot at one side, so that it can be turned to cover the hole, or to uncover it, to any desired extent. By turning the disc the air supply to the flame can be governed and adjusted so as to give the best result. Mr. Terrace, of the Tradeston gas works, Glasgow, has tried a series of experiments with this device and finds that it has the effect of improving the duty yielded by the gas to the extent of 20 to 30 per cent. Globes fitted with Mr. Gardner's simple arrangement ought, therefore, to find a ready sale.

An Irish newspaper publishes a complaint, presumably from a member of the sooty fraternity, as to the "unfairness" of the local gas companies in fixing gas stoves and so interfering with the business of chimney sweeping. No doubt the sweep has little ground for expecting an increase of business. People are slowly—very slowly—learning that it is better and cheaper to convert all the carbon into carbonic acid, and to secure the benefit of the heat thus evolved, than to deposit it in their flues as soot. The age of smokeless fuel will come, and it is not likely to be kept back by considerations of sympathy for the sweep, much less on account of anything in the way of vested interests in his business. His visits are regarded as a necessary nuisance, and would gladly be dispensed with. But owing to the slowness with which the public move in matters concerning their everyday welfare, he may count on no very great loss of business for many years yet.

The recent strikes of gas workers in Manchester, Salford, and London, offer a very large field for instruction. The experience thus gained leads to several conclusions of a general nature, useful to those who undertake the organization of labor disputes, beside those interesting to gas companies, with which we are specially concerned. It has shown that the business of gas making can be carried on, if need be, by ordinary, able-bodied laborers, under intelligent supervision, and that a matter of a fortnight or so is quite sufficient to make a fairly competent scoop driver or coke drawer of a raw recruit. In agitating for shorter hours of labor, the malcontents themselves have greatly aided this result, for it is only reasonable to suppose that a man unused to furnace work would become inured to exposure to heat with much greater facility on the eight hour, than on the twelve hour shift. The great stronghold of the stoker was not skill so much as strength and endurance. This has been broken into considerably by the reduction of hours of labor, and numerous other privileges so freely accorded by the companies, and I hear that men used to light labors only—clerks out of employ, hawkers and petty tradesmen, and such like—are able to undertake retort house work without discomfort. Another point unmistakably set forth is, that new hands take much more kindly to the scoop as compared with shovel charging. Some of this may be due to the fact that a badly charged retort is great trouble to an experienced rake hand, and of course much more so to a new beginner. But the chief lesson is the fact that in cases where the men have always been treated liberally, and no act of tyranny or oppression can be put forward as a cause for the strikers, the position of the employers is very strong, and that of the laborers is at a corresponding disadvantage. Had it been known that injustice of any kind was exercised toward the men, either at Manchester, Salford, or South London, the vacancies created by the continued withdrawal of the old hands would not have been so quickly filled up. The only chance of conducting a strike with any reasonable hope of success, is when a good case can be made out for public sympathy, or where, on account of special skill or other peculiarities of the work, the place of the strikers cannot be filled up. So far as the gas industry is concerned, it is to be hoped that the recent experience, disastrous as it has proved to many a steady and respectable working man, will not be without its use, as tending to promote a better understanding between employers and the employed. It may lead the latter to see that their masters are not necessarily their enemies, nor labor agitators their friends; whilst the former may reflect that payment of wage is not everything. The places referred to above are rather noted for kindness to the men than otherwise, but there are many employers of labor who need to be reminded that a little sympathy with the monotonous life of the toiler, a litle endeavor in the way of brightening his colorless existence, is not thrown away,

The advance of civilization certainly increases our sorrows in one respect, and that is in regard to the various dangers that beset us on our way through life. The latest public scare is that called the influenza epidemic, which is said to have raged all over Europe. The plain fact is that with the recent cold, damp, and extremely variable weather, coupled, perhaps, with the free living usually indulged in at this season of the year, has rendered ordinary catarrh more prevalent than usual of late. In gas circles a great deal of attention has been directed towards the dangers of water gas, and also those of electricity. As usually happens in these cases, a great deal of exaggeration has occurred in both directions, and the main points at issue have been obscured or greatly distorted. One or two zealous individuals, roused by accidents that have come within the narrow range of their own personal experiences, have promulgated their views on the poisonous nature of water gas or of electricity, as the case may be, and being very scantily informed as to the principles of chemical and electrical science, have done more harm than good. Others, whose interests happen to be concerned, have hastily flown into print with a view of counteracting the effects of such statements on the mind of the public, and have proved too much. The accident at the Leeds forge, alluded to in my last letter, has been pronounced to be due to water gas. At the last moment the Company withdrew their attempts to account for it in other ways. But this accident is not sufficient to condemn water gas. Undoubtedly it is more poisonous than coal gas, just as a solution of arsenic containing 35 grains of that death-dealing element would be more poisonous than one containing only 7 grains. Yet both solutions might be safely used with the observance of proper precautions, and mixtures containing 20 or 30 per cent. of carbonic oxide might be distributed to the public as safely as ordinary coal gas, provided that the proper means were taken to guard against accident. The same considerations apply to electricity, the distribution of which is attended with special dangers. It is useless to deny the existence of such dangers, on the one hand, or to decry them as utterly unavoidable and without remedy on the other. Once let the principles underlying them be ascertained and clearly defined, and the precautions necessary to prevent them can readily be determined. Whilst deprecating recklessness, we must not run into the avoidance of every possible source of danger.

The current number of the *Journal of Gas Lighting* contains some interesting observations by Mr. G. C. Trewby, Chief Engineer of the Gas Light and Coke Company, on the information gathered during his recent visit to America, for the purpose of investigating the various water gas processes that are in operation in that country. He thinks that if anything is done in the way of introducing water gas into this country to any large extent, it will probably be by means of the importation of Russian petroleum, which is likely to be delivered in England at a cheaper rate than the American product, with the exception, perhaps, of Lima oil. Mr. Trewby acknowledges the cordial manner in which he was received by gentlemen connected with the gas industry, both in America and Canada, with whom he came in contact.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. James C. Lord, who had been in charge of the Washington (Ind.) Gas Light Company's plant since March, 1877, has been appointed Superintendent of the Fort Worth Gas and Electric Light Company, Fort Worth, Texas. Mr. Lord is quite conversant with the electric light business, as the Washington Company was also engaged in the furnishing of electric currents. He is to be congratulated on his promotion to so large a field as Fort Worth certainly is, and his new employers are also to be congratulated on having secured such a competent man. We make no doubt that he will be fully up to the responsibilities of his new post, which will prove to be anything but the berth of a sinecurist.

Mr. Edward P. Gartland, of the St. Louis Gas, Fuel and Power Company, has been named to succeed Mr. Lord at Washington, Ind.

Mr. C. T. Yerkes has been elected President of the Chicago (Ills.) Gas Light and Coke Company, vice Mr. Theobald Forstall. The First and Second Vice-Presidents chosen are C. R. Cummings and C. G. K. Billings respectively. The changes in the Board of Directors are the replacing of Messrs. Theobald Forstall, C. N. Fay, and W. W. Gibbs by Messrs. E. C. Benedict, Henry Fitzhugh, and F. S. Winston.

The authorities of Rome, Ga., have determined to sell at auction shortly all the old gas lamps and posts that have been put out of service because of the adoption of electricity for illuminating the streets. Perhaps they would be doing about as well if they stored them for a while.

We understand that Mr. Andrew C. Daniel, a member of the Board of Directors of the Consolidated Coal Company (St. Louis, Mo.) has purchased a controlling interest in the Danville (Ills.) Gas Light Company.

The Edison Electric Illuminating Company, of Boston, has announced a reduction (to take effect Feb. 1) in the rate per hour for each 16-candle incandescent lamp. The new schedule calls for 1 cent per hour, as against the ruling one of 1¼ cents per hour.

Mr. Henry Skillman has been appointed Secretary of the Lexington (Ky.) Gas Company. By the way, what has become of the gentlemen who some months ago succeeded in inducing the City Council to grant them an ordinance for the operation of a fuel gas plant in this place?

At the annual meeting of the Spencer (Mass.) Gas Company the following officers were chosen: President, Hon. Luther Hill; Vice-President, Hon. Geo. P. Ladd; Treasurer Richard Sugden; Secretary, Emerson Stone. The matter of raising the gas rate to $1.50 per 1,000 (it is now $1.25) was discussed, but the shareholders finally decided—and by unanimous vote—not to make any change. The average candle power of the gas sold by the Company during 1889 is returned at 20.70.

The Directors of the Jefferson City (La.) Gas Light Company have declared a dividend of 2½ per cent. out of the earnings for the 6 months ended Jan. 1.

H. E. Byron, Corporation Clerk of Linwood, Ohio, advertises for proposals for the lighting of 75 public lamps, hours of lighting same to be based on a moontable averaging 18 nights per month. Deodorized gasoline (74°) is to be the illuminating agent, and the bidder is to agree to keep the lamps "clean and in good repair." The contract is to run for 3 years, and the competition closes at noon of Friday next.

Justice Fursman, of Troy, N. Y., on application of Judge Wilkinson has appointed Messrs. J. Irving Wendell, J. Crawford Green, and Geo. A. Stone, of Troy, appraisers to determine the value of 362 shares of stock in the old Troy Citizens Gas Light Company, held by Cornelius Callahan and others, of this city. Callahan refused to accept the price allotted the other shareholders when the terms for the consolidation of the three independent Troy gas companies were being arranged.

In Circuit Court, before Judge Bartlett, a novel suit was brought by one John O'Brien, against the Manhattan Elevated Railway Company, plaintiff asking for damages for personal injuries in the sum of $15,000. In presenting his case, counsel for plaintiff explained that O'Brien, in the performance of his labors for the Company—he was at the time of the accident hauling coal in cans to a platform in the structure owned by defendant, at the corner of Morris and Greenwich street—he had to step upon a single plank. Owing to insufficient light—it was early in the morning in the winter season—he slipped and fell, receiving injuries that resulted in gangrene of the lungs. From the evidence it was shown that the gas service pipe had been rendered temporarily useless because of "the gas being frozen therein." After testimony for plaintiff had been submitted, Mr. Ward, of counsel for defendant, moved to dismiss the case on the following grounds: The contributory negligence of the defendant; his acceptance of the risks attaching to his employment; the absence of proof of negligence on the part of the defendant, and that the accident was not of a nature for which the Company could be held blamable. After hearing counsel, Judge Bartlett said: The only negligence of which there is any proof at all is the failure of the defendant to keep the place properly lighted where the plaintiff was injured. Counsel for the plaintiff, upon the argument of this motion to dismiss the complaint, assert positively—what I am inclined to think the evidence shows, but they assume the position whether the evidence shows it or not—that this place where the accident occurred had always previously been sufficiently well lighted to enable the workmen there to do their work safely. As I have already suggested, the law does impose upon the master the obligation, which he cannot delegate or evade, of providing his servant with a safe and suitable place in which to do his work, or at all events, to use due diligence to make such provision. That obligation is generally, if not always, fulfilled by providing such a place as shall be safe and suitable in the first instance. I think that rule may be stated without any qualification, so far as premises or machinery are concerned, which are not apt to become dangerous simply by the lapse of time or the failure to inspect. So that this Company did their full duty to this employee and the others who were called upon to work in the same place, when they provided, so far as this case is concerned, suitable light at the point where the accident happened. That obligation they have fulfilled always up to the present time. I am unable to see how any negligence can be imputed to them, unless it is held either that they were bound to daily and almost hourly inspection of the gas there, which I think would be unreasonable, or unless some notice had been given to them of the dark condition of that part of the building. It does not appear to have come to anybody's attention that the place was dark until this man—very unfortunately, and we must assume, for the purpose of this motion, without any negligence on his part—suffered this injury. But we cannot shut our eyes to the fact that there are a great many accidents that are inevitable, or at all events for which nobody is to blame. I am inclined to think, on the evidence in this case, that the law does not hold the defendants liable; that they had fulfilled their obligation to keep the place properly lighted always theretofore; that they had no notice that it was dark on this occasion, and I cannot see in the surrounding circumstances or in the lapse of time anything which ought reasonably to have put them upon such notice. For these reasons the motion to dismiss this complaint must be granted.

The Citizens Gas Light Company (Newark, N. J.) has elected the following Directors: Messrs. A. A. Smalley, S. H. Condict, W. Clark, John L. Blake, C. A. Lighthipe, H. C. Kelsey, G. A. Halsey, Edmund L. Joy and H. Powles.

According to the reports of the Gas Bureau (Phila., Pa.) the receipts for the year 1899 were $3,658,224.83, and the expenditures, $2,851,019.51, leaving a cash profit of $807,205.32. The expenditures, however, included $292,146.08 spent for extensions, so that the real profit from works operation was $1,099,351.40. The receipts for the previous year were $3,870,383.69, and included $125,000 paid by the Schuylkill River East Side Railroad Company for damages to the Fifteenth Ward works. For the same time the expenditures were $3,321,962.74. The receipts as compared with those of the preceding year were as follows: For gas, services, etc., at main office (1888), $2,177,329.52; 1889, $2,178,704.53. Spring Garden office (1888), $869,174.72; 1889, $903,922.02. Germantown office (1888), $125,458.99; 1889, $124,413.33. Frankford office (1888), $62,803.10; 1889, $61,812.18. Manayunk office (1888), $46,586.71; 1889, $46,486.65. For coke, tar, etc.: At Market street works (1888), $218,544.08; 1889, $170,322.69. Point Breeze works (1888), $105,832.89; 1889, $94,708.04. Manayunk works (1888), $3,890.13; 1889, $3,485.03. Richmond works (1888), $130,603.10; 1889, $56,501.31. For rents, repairs to mains, damages, etc., $17,869.05. The falling off in the receipts from the sale of coke, tar, etc., is accounted for by the manufacture of water gas. A comparison of expenditures shows the following:

Account.	Year.	Amount.
For works.....	1888.....	$128,568.32
" "	1889.....	276,386.39
For mains.....	1888.....	163,576.36
" "	1889.....	140,848.59
For services.....	1888.....	91,059.71
" "	1889.....	96,779.68
For gas.....	1888.....	2,120,011.73
" "	1889.....	1,654,772.85
For repairs.....	1888.....	273,088.87
" "	1889.....	273,689.55
For public lighting...	1888.....	157,809.32
" " "	1889.....	82,304.40
Miscellaneous.	1888.....	386,848.43
"	1889.....	326,238.05

In addition to the gas sold, about 650,009,000 cubic feet were manufactured for and used by the city without cost, and if this were paid for at the rate of $1.50 per 1,000 the receipt for the same would bring the total profit of the works up to $2,074,351.40.

One of the local dailies, in commenting on these figures, believes the outcome is very creditable to Gen. Wagner's direction and Chief Park's supervision, and follows the encomium by remarking that "it (the report) demonstrates very clearly that the city would have been foolish to have sold the works a year or two ago at any price, much less at the price originally offered." The same authority also believes that as Gen. Wagner has met with so great a measure of success in carrying on the gas works bureau, a municipal electric lighting plant ought also to be installed and committed to his care.

In the meantime it seems to us that if the figures submitted prove anything at all they are most potent in the line of showing that Philadelphia gas rates are altogether too high. Gas should be sold in that city certainly at a figure not in excess of $1.25 per 1,000, with, say, 10 cents per M. off for prompt payment.

The Brown estate holding (which comprised a majority of the shares) in the Madison (Wis.) Gas Light Company has been purchased by Western capitalists.

Among the recommendations submitted by the "Committee of 17," appointed some time ago to report desirable amendments to the city ordinances of Dunkirk, N. Y., is one to the effect that hereafter all gas and water services from street main to cellar wall lines shall be of leaden pipe.

At the annual meeting of the Hartford City (Conn.) Gas Light Company the following Directors were elected: Messrs. John P. Harbison, F. B. Cooley, J. L. Howard, H. K. Morgan, George Roberts, Hugh Harbison, Atwood Collins, Nathaniel Shipman and Rodney Dennis.

THE Council of Fort Worth (Texas) has decided to accept the report from its sub-committee, which recommended that a municipal electric lighting plant be installed, at a cost not to exceed $27,000. Arc and incandescent lamps are to be maintained—the Brush type to be employed for the former, the Edison being selected for the latter.

THE owners of the franchise for the establishment of a gas and electric lighting plant at Cicero, Ills., will erect the gas works this spring.

THE proprietors of the Niagara Falls (N. Y.) Gas Company have chosen the following officers: President, S. M. N. Whitney; Secretary and Treasurer, A.W. R. Henning. Directors, S. M. N. Whitney, Amos W. R. Henning, W. F. Evans, W. B. Rice, Benjamin Flagler, Francis R. Delano, E. E. Davis, J. Vedder and S. F. Symonds.

THE Phœnix, Arizona, gas works (built 3 years ago) comprises an oil gas plant of the type manufactured by W. Smith, of Pittsburgh. The daily capacity of the works is about 30,000 cubic feet; the holder capacity is equal to 66 per cent. of the maximum make; the main mileage is 1½, and 12 street lamps are paid for by the authorities. The works cost $30,000. The officers are: President, N. C. Parsons; Vice-President and Treasurer, J. H. White; Secretary, A. P. Wade; Superintendent, H. Ohnick.

THE Directors of the Peoples Gas Light Company (Cleveland, O.) have named the following executive management: President, Geo. H. Warmington; Secretary and Treasurer, Julius M. Carrington; Supt. and Engineer, Edward Lindsley; Asst. Supt., Daniel Warmington.

THE following are the bids submitted in response to the invitation of the authorities for tenders for the public lighting of Clinton, Iowa:

Bidder.	No. of Nom. 2,000 c. p. Arcs.	Actual Candle Power.	No. Incan. Lights 32 c. p.	No. Incan. Lights 25 c. p.	Price per Light per Annum.
Excelsior Electric Co. (burn all and every night).....	any	1,600	....	....	$90 00
Clinton Gas Lt. & Coke Co. (all night P. G. and M. T.)	45	700	....	....	75 00
Clinton Gas Lt. & Coke Co.	....	....	200	....	20 00
Clinton Gas Lt. & Coke Co.	....	....	225	....	18 00
Brush Electric Co. (burn all night P. G. and M. T.)....	50	....	....	....	130 00
Brush Electric Co. (burn all and every night).....	50	....	....	....	142 50
Schuyler Electric Co. (burn all and every night).....	75	....	....	....	150 00
Fort Wayne Electric Co. (burn all and every night)	50	1,700	....	....	137 50
Fort Wayne Electric Co. (all night P. G. and M. T.)	50	....	....	....	125 00
Fort Wayne Electric Co. (on nights dark by clouds)....	50	....	....	....	130 00
Keystone Const. Co. (burn all night P. G. and M. T.)	20	700	....	....	78 00
Keystone Const. Co.....	....	....	75	....	22 00
Keystone Const. Co.....	....	....	....	75	20 00

THE following letter holds several good hints:

TONAWANDA, N. Y., Jan. 18, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL: It is with pleasure and interest that your valuable issues of gas items, appearing from time to time, are perused, the reader extracting therefrom good and valuable information. As yet, however, I have seen nothing to "elevate" and do justice to one of the most important accessories of our business, viz., the much abused and condemned gas meter—innocence and purity are fully stamped on its face. A silent, just and honorable calling it has to perform; and as a just monitor between man and man it should be justly treated and respected. Yet, when placed in a building, some dark, out-of-the-way corner is selected for its location—"out of sight, out of mind," seems to be the custom. Consumers should for their own protection have their meters in convenient and accessible places. By so doing the consumers can easily read their meters and control the flow of gas, thus helping the faithful meter taker in the prosecution of his duties.—METER.

THE proprietors of the Tonawanda (N. Y.) Gas Light Company are now about to enjoy the fruits of their intelligent scheme of reorganization, that was perfected some two years ago, and there can be little doubt that a good round dividend rate will soon be their reward. The rates for gas, determined on the first of the year, and which are to rule for the present, are:

Monthly Consumption.	Net Rate per 1,000.
4,900 cu. ft. and under....	$1.50
5,000 " to 15,000 cu. ft.....	1.40
15,000 " and over.....	1.25

Street lamps for public lighting are supplied at the very low rate of $18 per post, on an all night burning table. These rates are surely of the liberal sort, and cannot fail to tell in the increasing prosperity of the Company.

MR. GEORGE SHEPARD PAGE, of this city, sends the following greeting to the fraternity:

HOTEL METROPOLE, MONTE CARLO, Jan. 7, 1890.

Dear Mr. Editor:—Possibly some of the readers of the JOURNAL, as well as yourself, will be interested to know that Mrs. McMillin, with her two daughters and son, as well as Mrs. Page and the writer, are spending some days in this most delightful winter resort. Mrs. Page and I were in Rome during the Holidays. Mr. McMillin's family are to remain abroad for a year. Miss Stella McMillin will during that time be under the instruction of the famous Madame Lagrange, in Paris, perfecting the training of her already remarkable voice—a pure soprano.

Mrs. Page and I return to London towards the close of January. Notwithstanding a severe attack of influenza experienced in Rome, I am being greatly benefited by the needed rest from most active attention to business for the three past years. * * *

Wishing you all, and my many friends among your patrons, a happy and prosperous New Year, I remain,

Sincerely yours, GEO. SHEPARD PAGE.

THE enterprising proprietors of the Alton (Ills.) Gas and Electric Light Company have made many improvements on their establishment. The office quarters have been renovated and renewed. An automatic governor has been placed, and the new bench of retorts is equal to the work, that was expected from it. Supt. Tracy also informs us that an additional dynamo will be placed in the electric annex at an early date in the spring. He will also make a determined effort to popularize the use of gas for cooking and heating, and if his success at Alton will be like that obtained by him at Peru, Ind. (his old post of duty), a marked increase in day output will be the result.

AT the annual election of the Williamsport (Pa.) Gas Company the following result was reached: President, Hon. Joseph M. Gazzam; Secretary, Treasurer and Superintendent, C. A. Byers; Assist. Supt., M. J. Winters; Solicitor, Jas. G. Reading, Jr.; Collector, Jas. Calvert. Directors, the Hons. Jos. Gazzam, R. P. Allen and R. J. C. Walker, and Messrs. H. Mudge, John G. Reading, Jr., B. C. Bowman and John G. Reading.

MENTION of the election at Williamsport brings to mind one result of *la grippe* at that point. About a fortnight ago (the trouble lasted for two days) the people complained of bad gas, and the reason therefor was the sudden prostration, by an attack of influenza, of the working force in the purifying house.

A STILL more remarkable instance of the power of this unwelcome visitor is shown in the fact that the annual meeting of the stockholders in the Newport (R. I.) Gas Light Company (set for the 13th of January) had to be postponed for a fortnight—so many of the stockholders were suffering from the influenza that a quorum could not be gathered together at the appropriate time.

THE following Directors were chosen at the annual meeting of the Brooklyn (N. Y.) Gas Light Company: H. D. Polhemus, H. K. Shelton, A. M. White, Jas. H. Armington, H. H. Rogers, G. H. R. Lyman, A. E. Orr and W. Cary Sanger. We understand that Mr. Sanger has been elected to the Presidency.

THE Mansfield (Mass.) Gas and Electric Light Company has been incorporated by a score of local capitalists. Its President is A. F. Rogerson, and W. C. Winter is its Clerk and Treasurer. It is proposed to commence construction work on the gas plant next March. This place is in Bristol county, Mass., at a point 24 miles south and west of Boston, and 20 miles north, northeast of Providence, R. I. It is quite a manufacturing center—cutlery, straw goods, furnaces, spindles, etc.—and has a population of perhaps 5,500.

THE family of the laborer Guthrie, who was killed in the explosion at the Asheville gas works, have brought suit against the Company for $25,000 damages.

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Fully equipped; all the latest improvements; includes Generator, Purifiers, and Holder. Can be removed to any part of the country, and set up at small cost. For further information apply to BRADFORD GAS LT. & HEATING CO., Dunkirk, N. Y.

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One Hydraulic Main (five sections), wrought iron, 22 by 24, with Bye-Pass on Dip-Pipes.

25 Valves, Stand-Pipes, 7-inch Mouthpieces and Lids, all complete, ready for use, to fit up five benches of 5's.

This apparatus is all in first-class condition.

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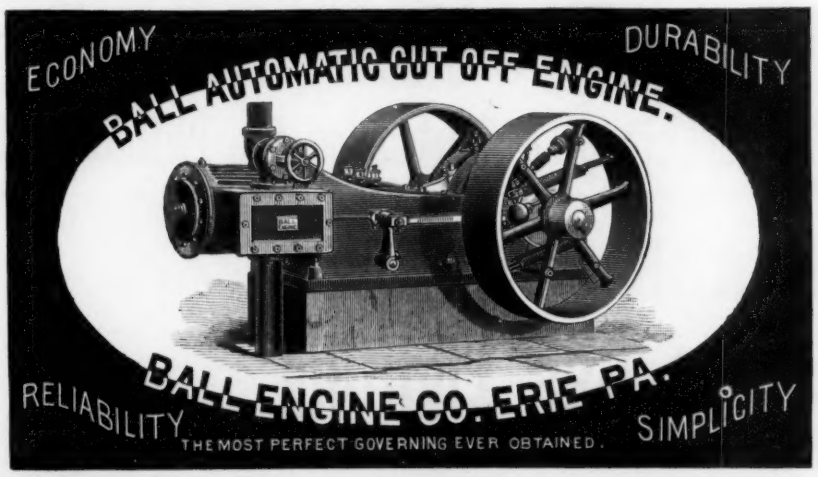

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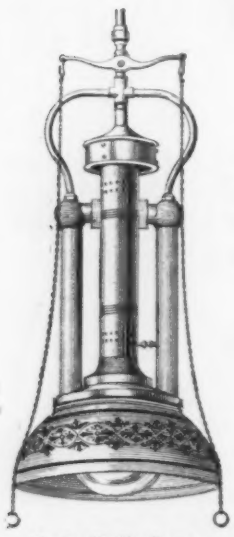

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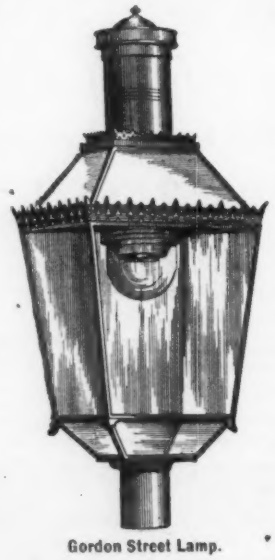

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OF
Incandescent Gas Lighting.

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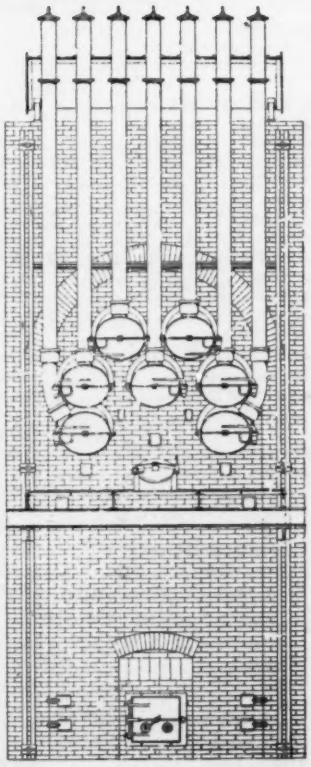

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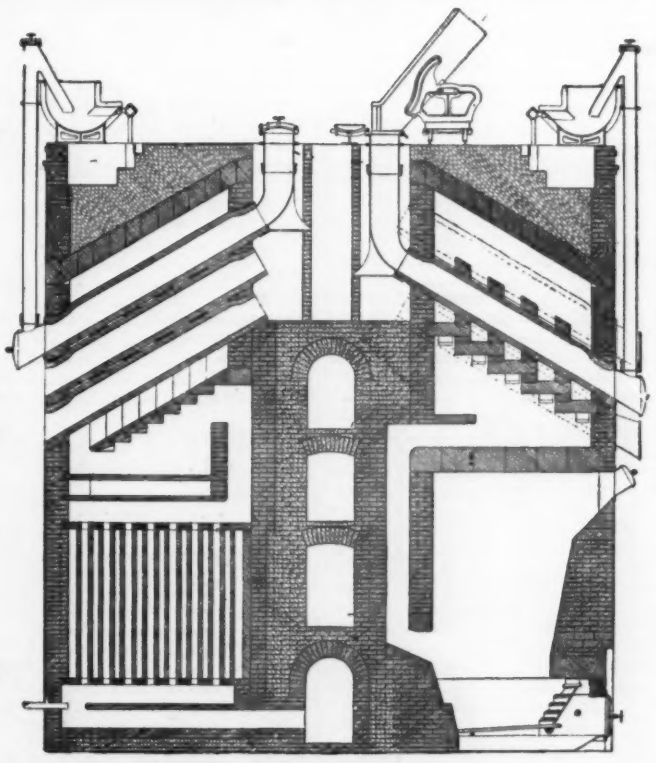

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	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" " Citizen	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
" Nassau	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusseldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z.	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A.	430,000
Newmarket	150,000
Newark, U.S.A.	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland,	1,500,000
St. Josephs, U.S.A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A.	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A.	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A	750,000
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Decatur Gas Lt & Coke Co.	Decatur, Ill.
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Chippewa Falls Gas Lt. Co.	Chippewa Falls, Wis.
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Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co	Salina, Kansas.
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Jefferson City Gas Lt. Co	Jefferson City, Mo.
Mankato Gas Light Co	Mankato, Minn.
Lima Gas Light Co.	Lima, Ohio.
Minneapolis Gas Light and Coke Co.	Minneapolis, Minn.
Bellevue Water and Fuel Gas Light Co.	Bellevue, Campbell County, Ky.
Bucyrus Gas Lt. & Fuel Co.	Bucyrus, Ohio.
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Los Angeles Gas Co.	Los Angeles, Cal.
San Diego Gas Fuel & Electric Lt. Co.	San Diego, Cal.
Sioux Falls Gas Co.	Sioux Falls, Dak.
Dakota Gas and Fuel Co.	Grand Forks, Dak.
St. Johns Mutual Gas Co.	St. Johns, Mich.
Stillwater Gas Light Co.	Stillwater, Minn.
St. Paul Gas Light Co	St. Paul, Minn.
Emporia Electric and Gas Light Co.	Emporia, Kas.
Van Wert Gas Light Co.	Van Wert, Ohio.
Lansing Gas Light Co.	Lansing, Mich.
San Francisco Gas Lt. Co.	San Francisco, Cal.
Shelbyville Gas Light Co.	Shelbyville, Ind.
Great Falls Gas Light Co.	Great Falls, N. H.
Belleville Gas Co.	Belleville, Ontario
Rochester Lt. and Fuel Co.	Rochester, Minn.
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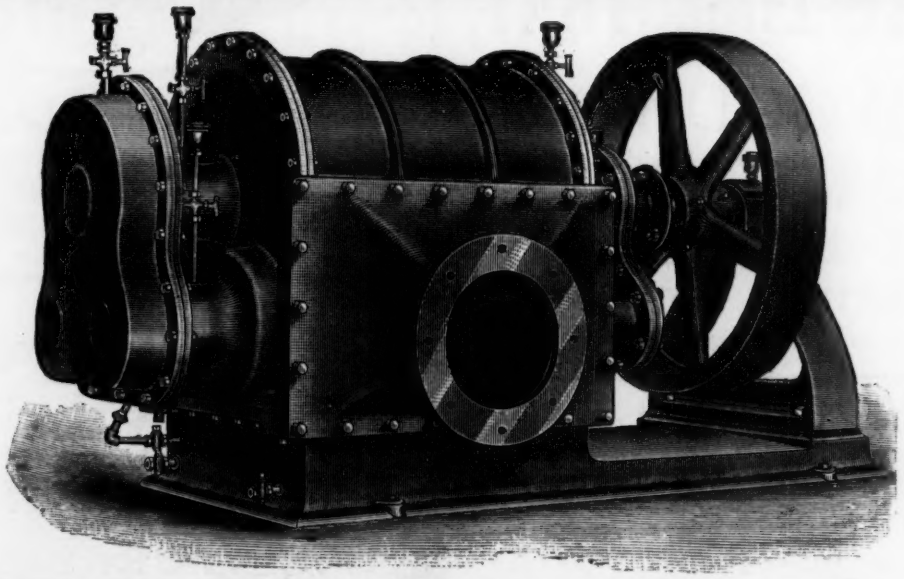

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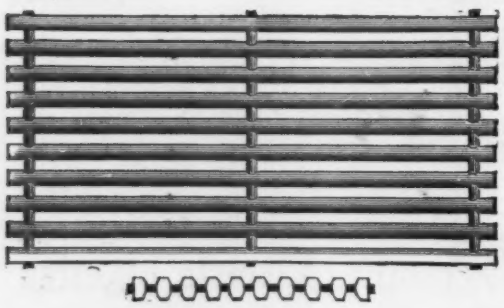

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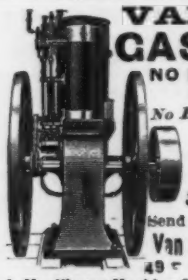

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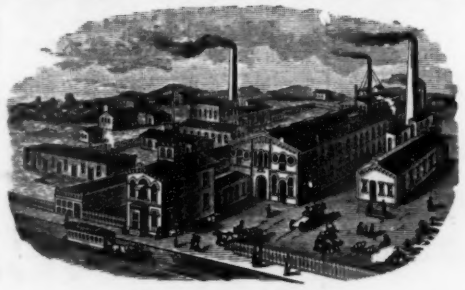

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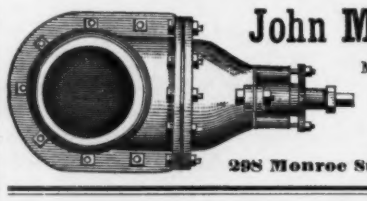

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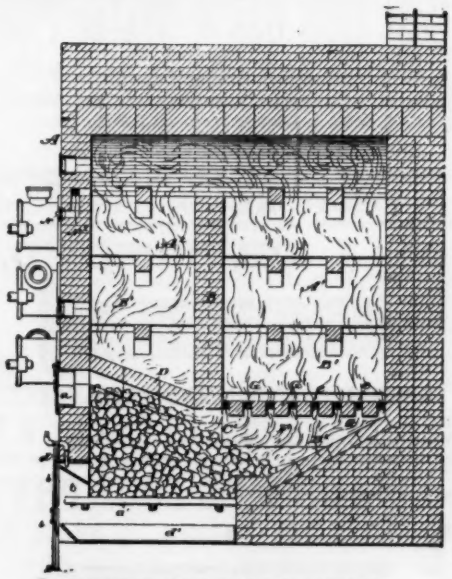

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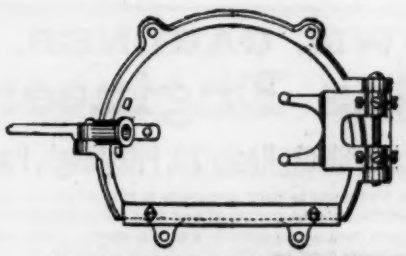

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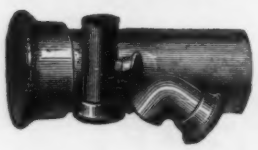

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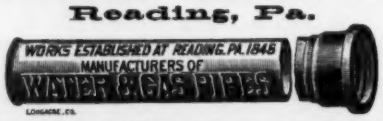

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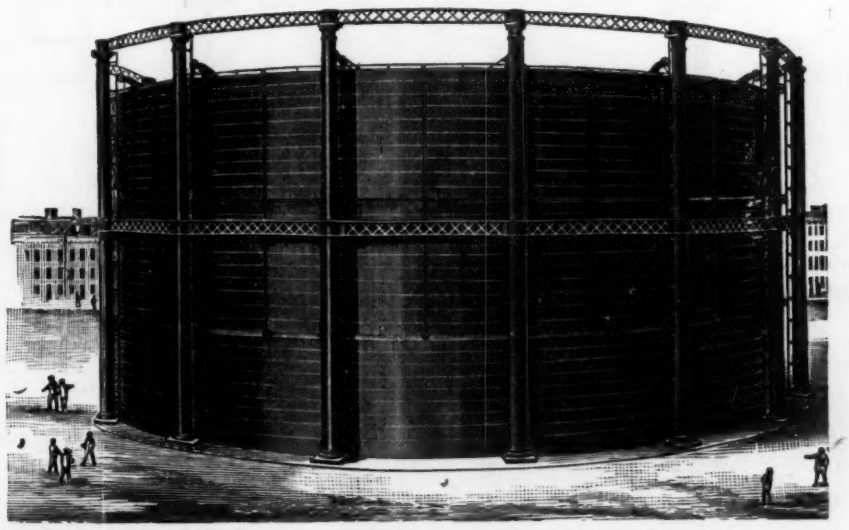

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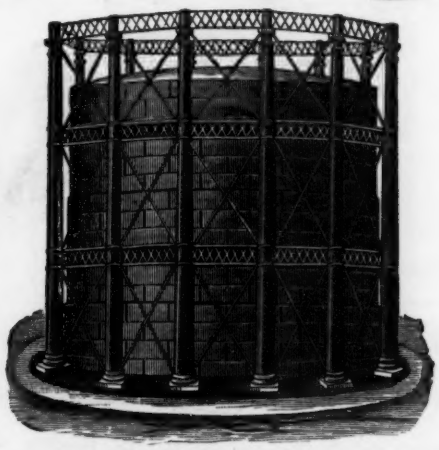

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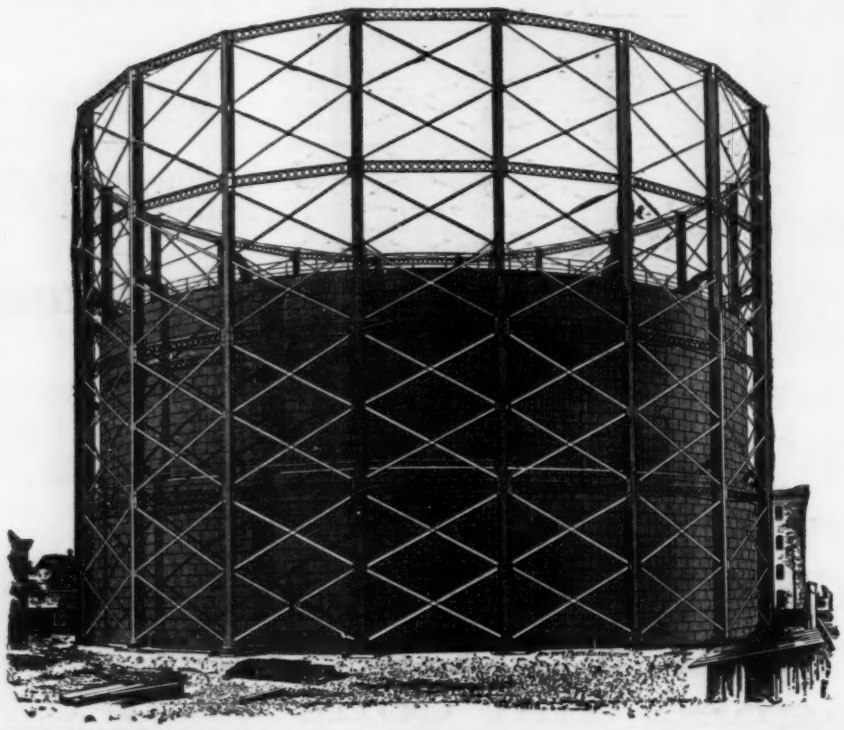

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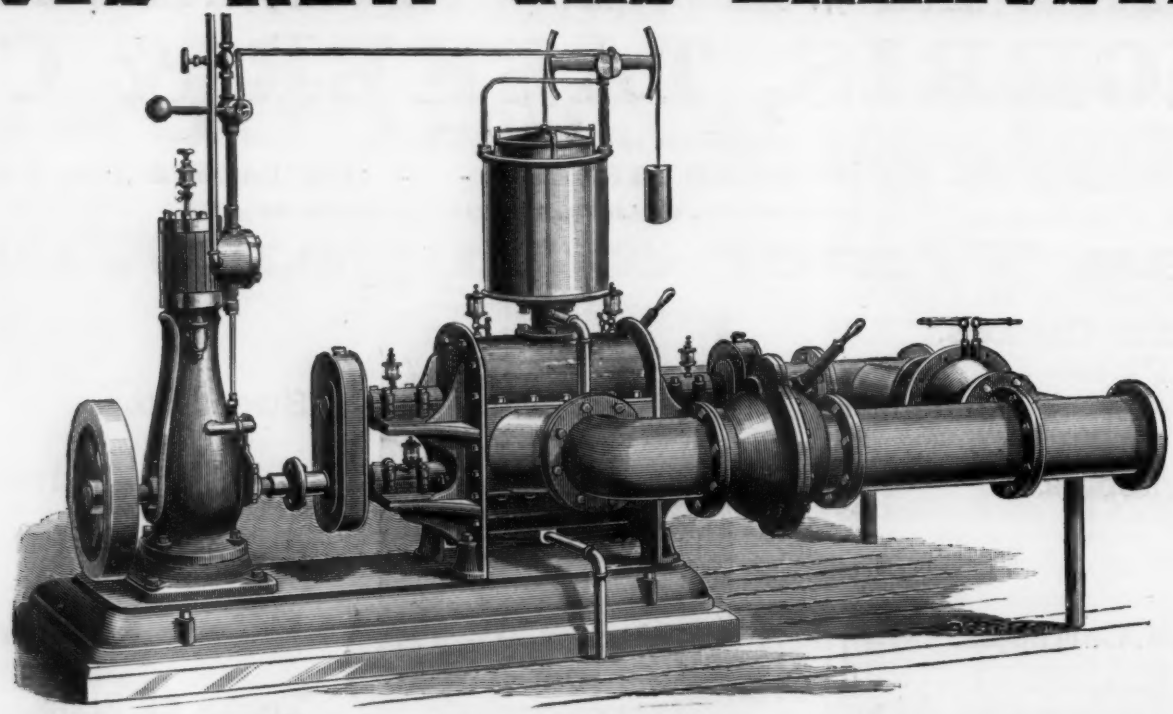

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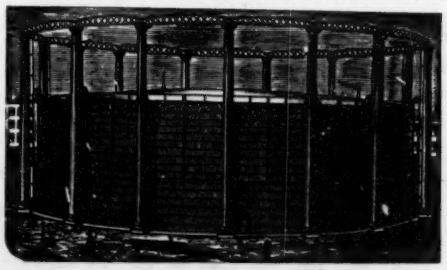
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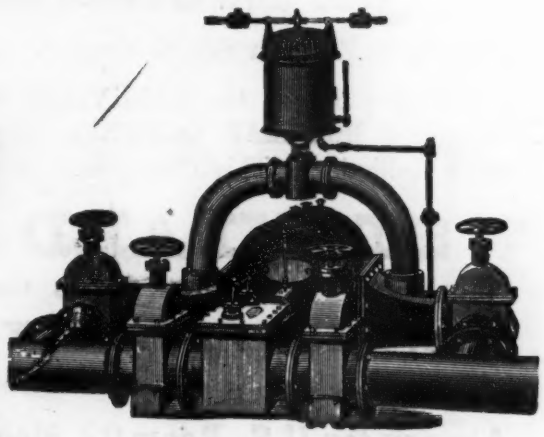

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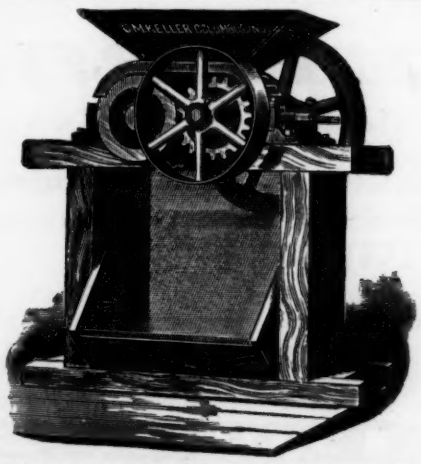

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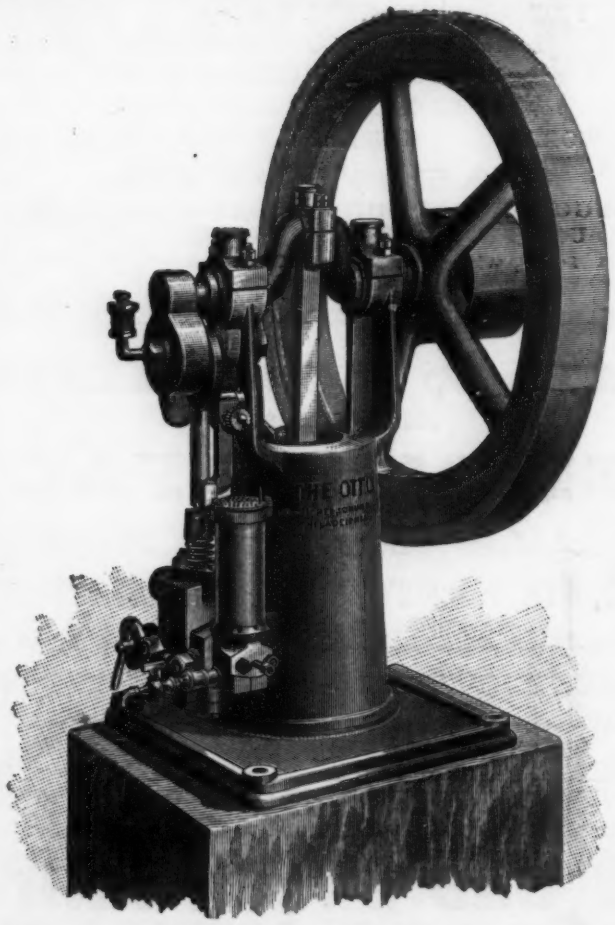

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